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ScienceDirect

Procedia Computer Science 60 (2015) 362 – 370

Procedia Computer Science

19th International Conference on Knowledge Based and Intelligent Information and Engineering Systems

A perspective on Knowledge Based and Intelligent systems implementation in Industrie 4.0

Carlos Toro[a]* , Iñigo Barandiaran[a] , Jorge Posada[a]

[a]Vicomtech-IK4 research Centre, Donostia San Sebastian (Spain)

Abstract

A worldwide trend in advanced manufacturing countries is defining Industrie 4.0, Industrial Internet and Factories of the Future as a new wave that can revolutionize the production and its associated services. Cyber-Physical Systems (CPS) are central to this vision and are entitled to be part of smart machines, storage systems and production facilities able to exchange information with autonomy and intelligence. Such systems should be able to decide and trigger actions, and control each other independently and for such reason it is required the use of Knowledge based and intelligent information approaches. In this paper we present our perspective on how to support Industrie 4.0 with Knowledge based and intelligent systems. We focus in the conceptual model, architecture and necessary elements we believe are required for a real world implementation. We base our conceptualization in the experiences gathered during the participation in different ongoing research projects where the presented architecture is being implemented.

Peer-review under responsibility of KES International

Keywords: Advanced Manufacturing, Digital Manufacturing, Industrial Internet, Industrie 4.0, intelligent systems

1. Introduction

The fourth industrial revolution is an idea that little by little is taking its pace in the roadmaps of companies and researchers alike. Local and regional governments are aware of the importance of ICT in industry, and for such reason, novel initiatives and funding programs are being developed and launched. Initiatives such as the Industrial

* Corresponding author. Tel.: +34 943309230
E-mail address: ctoro@vicomtech.org

Peer-review under responsibility of KES International
doi:10.1016/j.procs.2015.08.143

Internet and the Advanced Manufacturing Partnership in USA, the Industry 4.0 (Industrie 4.0 in German) [7], la Nouvelle France Industrielle, etc. are just a few of different examples of this vision. Even smaller regions with a long tradition in manufacturing are following the trend from their own local perspective (e.g. the Basque Country with their intelligent specialization policy RIS3 in Advanced Manufacturing). The overall idea as can be seen in Figure 1 is that there is a paradigm shift in nowadays interconnected systems that will eventually generate a new industrial revolution comparable to the one that steam power brought in the late 18th century.

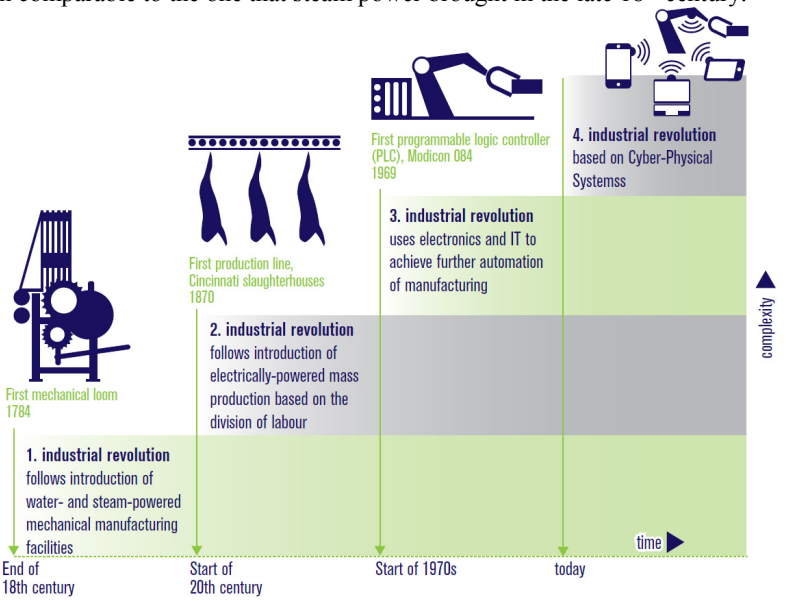

Figure 1. Industrie 4.0–The 4th Industrial Revolution with CPS [7]

The extensive use of IT systems in nowadays industries and the broad availability of technologies such as Big Data, Cloud and grid computing and of course semantics, promise to generate the added value that eventually will create a new interconnected factory [7]. A lot of talking has been taking place in different forums during the last two years concerning the Industrie 4.0 ideas and the possible ways to implement them in current manufacturing facilities [1]. The feeling of most managers of manufacturing companies is that this new revolution should be implemented as soon as possible in order to enhance their manufacturing lines with the so much desired intelligence that is promised. However the reality of many of the aforesaid companies is that they have to deal with the existence of legacy systems and monolithic solutions that in the best-case scenario would only provide limited interconnectivity by providing pretty basic data logs in sometimes-exotic formats.

In the aforementioned scenario, several important questions are to be answered. Arguably among those questions the first to come into mind could be:

- Q1: Which is the current status of my company? - In other words, in which stage of the evolution towards the next industrial revolution could my company be fitted?. Answering this question represents a good starting point in the process of considering strategies for bridging the existent learning and implementation gaps.
- Q2: What do I have to pay attention in order to implement the so-called next industrial revolution in the company? – Answering this question should inevitably lead towards software and hardware products, new normative, novel security and storage approaches, etc. It could also provide relevant information on which required elements are already present but incipient, which ones are not present and which ones are not relevant.